

The examiner has rejected all the claims as either anticipated by GB '700 (claims 1-5, 7-13, 15 -22), or rendered obvious by GB '700 in combination with Uemura (4,737,421), Fukuda (4,818,640), Grevstad (4,212,929), and GB '017 (GB 2,326,017).

However, as amended, all the claims now contain an express aspect of the invention that is neither taught nor suggested by the prior art: a BSP that *overlaps* the MEA. In his office action, the examiner implied that such a structure would be given "patentable weight," but that as written the claims did not "clearly require such an overlap to be present." (Office action, p. 5.)

Now they do. Each of the claims now expressly requires the BSP to be "rolled, bent over, or crimped . . . *so as to overlap a substantial portion of said flexible membrane electrode assembly.*" (See e.g. claim 2) (emphasis added). This overlap helps to "prevent the release of reactants from the fuel cell." (Id.)

Since this feature -- a BSP that is rolled, bent, or crimped so as to overlap the MEA -- is neither taught nor suggested by any of the cited prior art, all the claims of the present application must be allowed.

Comments Regarding Amendments

Like the amended claims, new claims 23 - 37 also require an overlap between the BSP and MEA, and are therefore patentable for the reasons identified above. In many

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respects, these new claims track the existing ones, and are entered to improve claim clarity by eliminating extraneous language, and not for any reason related to patentability.

Comments Regarding Objections

In response to the examiner's objection, the "Related Applications" section has now been amended to conform to current practice. Also, the applicants have shortened the abstract as requested, and converted it to a single paragraph. Finally, in response to the examiner's objection, claim 21 has been canceled.

Amendments

To the Specification:

Please amend the first paragraph to read:

This application is a continuation-in-part of U.S. Ser. No. 09/834390, 60/226,471, filed Aug. 18, 2000 and U.S. Ser. No. 60/249,662, filed Nov. 17, 2000, and U.S. Ser. No. , filed Apr. 13, 2001, (now abandoned). It also claims benefit from U.S. provisional application no. 60/226,471, filed Aug. 18, 2000 and U.S. provisional application no. 60/249,662, filed Nov. 17, 2000. ~~all of which~~ The disclosures of each of these applications are incorporated herein by reference in their entirety.

Please amend the abstract to read:

~~The present invention concerns improvements in fuel cell fabrication. It concerns an improved, integrated and modular BSP/MEA/Manifolds, which facilitates single cell (module) leak and performance testing prior to assembly in a fuel cell stack as well as facilitating manufacturing and cost reduction.~~

~~In particular, the~~ The present invention relates to a fuel cell,

which includes: a) ~~A~~ a single flexible or ridged separator plate; b) a flexible membrane electrode assembly; and c) a flexible bond interposed between said single flexible or ridged separator plate and said flexible membrane electrode assembly. The separator plate is rolled, bent, or crimped so as to overlap a substantial portion of the electrode assembly, thereby preventing leakage of reactants. The present invention facilitates single cell (module) leak and performance testing prior to assembly in a fuel cell stack, as well as efficiency and cost-reduction in manufacturing. ~~wherein said flexible bond between said flexible or ridged separator plate and said flexible membrane electrode assembly comprises the fuel cell, and wherein said flexible bond is an adhesive bond which encapsulates edge portions of said flexible or ridged separator plate and said flexible membrane electrode assembly and wherein said flexible bond seals the edge portions of said flexible membrane assembly to prevent the release of reactants from the fuel cell. In some embodiments the adhesive bond comprises a flexible gasket; d) manifold for the delivery and removal of reactants and reactant products to and from the fuel cell reactive areas where said manifolds may be either a single or~~

~~multiple manifolds; and e) a bond interposed between said manifold and said single flexible or ridged separator plate, wherein said bond affixes said manifold to said flexible or ridged separator plate and wherein said bond provides a seal between said manifold and said flexible or ridged separator plate to prevent the release of reactants from the fuel cell. It also eliminates some gaskets and simplifies assembly.~~

To the Claims:

1. (canceled)

~~A fuel cell comprising:~~

- ~~a. a single flexible or ridged bipolar separator plate;~~
- ~~b. a flexible membrane electrode assembly;~~
- ~~c. a flexible bond, seal or gasket interposed between said single flexible or ridged separator plate and said single flexible membrane electrode assembly, wherein said flexible bond, seal or gasket between said flexible or ridged separator plate and said flexible membrane electrode assembly comprises the fuel cell module, and wherein said flexible bond, seal or gasket may or not be an adhesive bond, seal or gasket which encapsulates edge portions of said flexible or ridged separator plate and said flexible membrane electrode assembly and wherein said flexible bond, seal or gasket seals the edge portions of said flexible membrane assembly to prevent the release of reactants from the fuel cell;~~
- ~~d. a manifold for the delivery and removal of reactants and reactant products to and from the~~

~~fuel cell reactive areas where said manifolds may be either a single or multiple manifolds; and
e. a bond interposed between said manifold and said flexible or ridged separator plate, wherein said bond affixes said manifold to said flexible or ridged separator plate and wherein said bond provides a seal between said manifold and said flexible or ridged separator plate to prevent the release of reactants from the fuel cell.~~

2. (currently amended)

A fuel cell comprising:

- a. a single flexible or ridged bipolar separator plate;
- b. a flexible membrane electrode assembly;
- c. a flexible seal, adhesive or gasket interposed between said single flexible or ridged separator plate and said flexible membrane electrode assembly, wherein said flexible seal, adhesive or gasket between said flexible or ridged separator plate and said flexible membrane electrode assembly comprises the fuel cell module, and wherein said flexible seal, adhesive or gasket is

optionally an adhesive which encapsulates edge portions of said flexible or ridged separator plate and said flexible membrane electrode assembly and wherein said flexible seal, adhesive or gasket seals the edge portions of said flexible membrane assembly to prevent the release of reactants from the fuel cell, and where the edge portion of the flexible or ridged separator plate is ~~secured by~~ rolling rolled, bending bent over, or crimped ~~crimping~~ over the edge ~~or combinations thereof~~ of the said flexible membrane assembly so as to overlap a substantial portion of said flexible membrane electrode assembly ~~and the said flexible seal and pressed or crimped against the said flexible membrane assembly and the said flexible seal~~ to prevent the release of reactants from the fuel cell

d. a manifold for the delivery and removal of reactants and reactant products to and from the fuel cell reactive areas where said manifolds may be either a single or multiple manifolds; and
e. bond interposed between said manifold and

said flexible or ridged separator plate, wherein said bond affixes said manifold to said flexible or ridged separator plate and wherein said bond provides a seal between said manifold and said flexible or ridged separator plate to prevent the release of reactants from the fuel cell.

3. (currently amended)

The fuel cell of claims ~~1-2~~ 2 wherein said fuel cell is assembled as a single cell module which is assembled with additional single cell modules to create a fuel cell stack or unit.

4. (currently amended)

The fuel cell of claims ~~1-2~~ 2 wherein said fuel cell module in claim ~~23~~ comprises said single flexible or ridged bipolar separator plate, said membrane electrode assembly, said flexible adhesive bond, seal or gasket between said single flexible or ridged bipolar separator plate and said membrane electrode assembly, said manifold or manifolds, said adhesive bond or bonds interposed between said manifold or manifolds and said flexible or ridged bipolar separator plate.

5. (currently amended) The fuel cell of claims ~~1-or~~ 2 wherein said separator plate comprises a metal material, a composite material, a polymeric plastic material, or combinations thereof.
6. (currently amended) The fuel cell of claims ~~1-or~~ 2 above wherein the separator plate has a thickness between about 0.0001 inch and about 0.500 inch and area of between 0.1 inches square and 5000 inches square.
7. (currently amended) The fuel cell of claims ~~1-or~~ 2 wherein the separator plate is of a square configuration, a rectangular configuration or other polygonal configuration, a circular configuration or any other rounded configuration.
8. (currently amended) The fuel cell of claims ~~1-or~~ 2 above wherein said adhesive, seal or gasket is applied to said separator plate or said adhesive, seal or gasket is applied to said membrane electrode assembly and said separator plate and said membrane electrode assembly are bonded and or sealed together as a single unit.
9. (currently amended) The fuel cell of claims ~~1-or~~ 2 wherein said adhesive bond

of support ~~1c~~ or 2c is a gasket.

10. (currently amended) The fuel cell of claims ~~1-or~~ 2 wherein the gasket comprises a plastic polymeric material, or an elastomeric material, a composite material, a metallic material, a foam material, or combinations thereof.
11. (currently amended) The fuel cell of claims ~~1-or~~ 2 wherein said adhesive bond, seal or gasket ~~of~~ forms part of the reactant flow field.
12. (currently amended) The fuel cell of claims ~~1-or~~ 2 wherein said manifolds are external to the BSP and the MEA as to not cause disruption or through holing of the MEA either internal or external to the electrochemically active area.
13. (currently amended) The fuel cell of claims ~~1-or~~ 2 wherein said manifolds are bonded to said BSP.
14. (currently amended) The fuel cell of claims ~~1-or~~ 2 wherein said manifolds are compriseds of a plastic material, or a composite material, or a metallic material.

15. (currently amended) The fuel cell of claims ~~1 or~~ 2 wherein said manifold is a single manifold.
16. (currently amended) The fuel cell of claims ~~1 or~~ 2 wherein said manifolds are multiple in nature up to 26 manifolds.
17. (currently amended) The fuel cell of claims ~~1 or~~ 2 wherein said manifolds have passages for a single reactant or multiple reactants and or a coolant or multiple coolants.
18. (currently amended) The fuel cell of claims ~~1 or~~ 2 wherein the ~~said~~ bond between said manifold or manifolds and said membrane electrode assembly comprises a plastic material, an elastomeric material, a composite material, a metallic material, a foam material, or combinations thereof.
19. (canceled) ~~The fuel cell of claim 2 wherein the bent, crimped or rolled edge is a separate part.~~
20. (original) The fuel cell of claim 2 wherein the bent, crimped or rolled edge is continuous or discontinuous around the periphery of the entire fuel cell.

21. (canceled) ~~The fuel cell of claims 1 and 2 wherein the bond, adhesive, seal or gasket material is applied manually, robotically, by printing, stenciling, silk screening, or other known methods of application.~~
22. (original) The fuel cell of claim 8 wherein the gasket comprises a plastic polymeric material, an elastomeric material, a composite material, a metal, a foam or combinations thereof.
23. (new) A fuel cell module comprising:
- a. a bipolar separator plate having a perimeter edge portion ("BSP");
 - b. a single flexible membrane electrode assembly ("MEA"), wherein the perimeter edge portion of the BSP is rolled, bent over, or crimped over the edge of the flexible membrane assembly so as to overlap a substantial portion of said flexible membrane electrode assembly, thereby aiding in preventing the release of reactants and reactant products from the perimeter of the module.

- c. a flexible bond, seal or gasket interposed between the BSP and MEA, wherein said flexible bond, seal or gasket seals the edge portions of the BSP and MEA to prevent the release of reactants from the edge of the fuel cell module;
- d. a manifold that is external to the BSP and MEA for delivery of reactants to and removing reactant products from the fuel cell reactive areas; and
- e. a bond between the manifold and the BSP to affix the manifold to the BSP and provide a seal between the manifold and the BSP to prevent the release of reactants from the fuel cell module.

- 24. (new) The fuel cell module of claim 23 assembled with at least one other fuel cell module of claim 23 to create a fuel cell stack.
- 25. (new) The fuel cell module of claim 23 wherein the BSP comprises a metal material, a composite material, a polymeric plastic material, or combinations thereof.
- 26. (new) The fuel cell of claim 23, wherein the BSP has a thickness

between about 0.0001 inch and 0.500 inch and an area of between 0.1 inches square and 5000 inches square.

27. (new) The fuel cell module of claim 23, wherein the BSP is of a square configuration, a rectangular configuration or other polygonal configuration, a circular configuration or any other rounded configuration.
28. (new) The fuel cell module of claim 23, wherein the adhesive, seal or gasket is applied to the BSP or MEA to bond them together as a single unit.
29. (new) The fuel cell module of claim 23, wherein the edge portions of the BSP and MEA are sealed with a gasket.
30. (new) The fuel cell module of claim 29, wherein the gasket comprises a plastic polymeric material, an elastomeric material, a composite material, a metallic material, a foam material, or combinations thereof.
31. (new) The fuel cell module of claim 23, wherein the adhesive bond, seal or gasket forms part of the reactant flow field.

32. (new) The fuel cell module of claim 23, wherein the manifold is bonded to the BSP.
33. (new) The fuel cell module of claim 23, wherein the manifold comprises a plastic material, a composite material, or a metallic material.
34. (new) The fuel cell module of claim 23, wherein the manifold is a single manifold.
35. (new) The fuel cell module of claim 23, wherein there is a plurality of manifolds.
36. (new) The fuel cell module of claim 35, wherein said manifolds have passages for a single reactant or multiple reactants and/or a coolant or multiple coolants.
37. (new) The fuel cell module of claim 38, wherein the bent, crimped or rolled edge is continuous or discontinuous around the periphery of the entire fuel cell module.

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Conclusion

For the reasons stated above, the present application has not been anticipated or rendered obvious by the cited prior art, and is ready for allowance.

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